

7. Katya

Program Name: Katya.java

Input File: katya.dat

Katya saw her brother working with 2-dimension arrays for his college math homework. He explained that the arrays are called matrices in math and he was performing matrix multiplication. He demonstrated the following example to his sister.

Start with two matrices (2-dimension arrays), matrix **A** with **n** rows and **m** columns and matrix **B** with **m** rows and **p** columns. The number of columns **m** in **A** must equal the number of rows **m** in **B**. Their product **C = AB** is a matrix **C** with **n** rows and **p** columns. Position **(i, j)** in the result matrix **C** is the sum of **m** products, the elements in row **i** of **A** multiplied by the elements in column **j** of **B**.

Matrix A $n \times m$ 3×4	Col 1	Col 2	Col 3	Col 4
Row 1	1	0	-3	2
Row 2	2	-3	0	2
Row 3	-3	0	2	3

Matrix B $m \times p$ 4×2	Col 1	Col 2
Row 1	-1	0
Row 2	2	-4
Row 3	-3	3
Row 4	0	-2

Matrix C $n \times p$ 3×2	Col 1	Col 2
Row 1	8	-13
Row 2	-8	8
Row 3	-3	0

$C(1,1)$ sums the products of row 1 from A and col 1 from B
 $= A(1,1) \times B(1,1) + A(1,2) \times B(2,1) + A(1,3) \times B(3,1) + A(1,4) \times B(4,1)$
 $= 1 \times -1 + 0 \times 2 + -3 \times -3 + 2 \times 0 = 8$
 $C(1,2)$ sums the products of row 1 from A and col 2 from B
 $= A(1,1) \times B(1,2) + A(1,2) \times B(2,2) + A(1,3) \times B(3,2) + A(1,4) \times B(4,2)$
 $= 1 \times 0 + 0 \times -4 + -3 \times 3 + 2 \times -2 = -13$
 $C(2,1)$ sums the products of row 2 from A and col 1 from B
 $= A(2,1) \times B(1,1) + A(2,2) \times B(2,1) + A(2,3) \times B(3,1) + A(2,4) \times B(4,1)$
 $= 2 \times -1 + -3 \times 2 + 0 \times -3 + 2 \times 0 = -8$
 $C(2,2)$ sums the products of row 2 from A and col 2 from B
 $= A(2,1) \times B(1,2) + A(2,2) \times B(2,2) + A(2,3) \times B(3,2) + A(2,4) \times B(4,2)$
 $= 2 \times 0 + -3 \times -4 + 0 \times 3 + 2 \times -2 = 8$
 $C(3,1)$ sums the products of row 3 from A and col 1 from B
 $= A(3,1) \times B(1,1) + A(3,2) \times B(2,1) + A(3,3) \times B(3,1) + A(3,4) \times B(4,1)$
 $= -3 \times -1 + 0 \times 2 + 2 \times -3 + 3 \times 0 = -3$
 $C(3,2)$ sums the products of row 3 from A and col 2 from B
 $= A(3,1) \times B(1,2) + A(3,2) \times B(2,2) + A(3,3) \times B(3,2) + A(3,4) \times B(4,2)$
 $= -3 \times 0 + 0 \times -4 + 2 \times 3 + 3 \times -2 = 0$

Katya realizes that is a lot of work for even a small example and decides to write a program to help her brother check his calculations.

Input: The first line of the data file contains the number of data sets. Each data set will contain a line with four integers: the number of rows r_1 and columns c_1 in the first array and the number of rows r_2 and columns c_2 in the second array. That line will be followed by r_1 lines each contains values for c_1 columns and then r_2 lines each contains values for c_2 columns. Whitespace separates all values. Maximum matrix size is 10×10 .

Output: For each data set, display a line that starts with the data set number followed by a colon. If array sizes are compatible ($c_1 = r_2$) display the number of rows and columns of the resulting array after the colon with the numbers separated by a comma. If not compatible, display the message “**SIZES NOT COMPATIBLE**” after the colon with no extra spacing. When they are compatible, display one line for each row of the resulting array with the column values displayed right aligned in fields exactly 5 characters wide and no additional spacing. After each data set, output a line containing exactly 12 carats “**^^^^^^^^^^^^**”.

Katya (cont.)

Sample input:

```
3
3 4 4 2
1 0 -3 2
2 -3 0 2
-3 0 2 3
-1 0
2 -4
-3 3
0 -2
4 6 5 4
7 6 -7 3 -1 4
-4 8 -1 8 -3 -8
2 -1 -6 -6 1 -6
4 5 1 6 -7 4
4 7 -9 -3
6 -9 -1 -4
-1 4 -5 6
9 -9 -3 0
8 6 -3 5
4 3 3 5
4 -1 3
3 -1 1
0 7 -1
6 2 7
-1 6 2 -5 3
3 -8 1 -1 3
-4 -6 -7 3 4
```

Sample output:

```
1:3,2
8 -13
-8 8
-3 0
^^^^^^^^^^^^
2:SIZES NOT COMPATIBLE
^^^^^^^^^^^^
3:4,5
-19 14 -14 -10 21
-10 20 -2 -11 10
25 -50 14 -10 17
-28 -22 -35 -11 52
^^^^^^^^^^^^
```